

Amendment under 37 C.F.R. §1.111
U.S. Application No. 09/372,636
Attorney's Docket No. 364/56

It is also known to provide improved cooling to casting dies subject to particularly high thermal stresses, in order to avoid premature damage to the casting die. This means in the case of thin-slab casting dies, ~~for one thing,~~ that the thermal resistance of the casting die wall should not be too great, for which reason thinner walls are chosen. Moreover~~For another thing,~~ given the higher pouring rates that ~~are aimed at~~targeted, particular demands are placed on cooling-water quality and flow rate.

Please replace the third paragraph on page 2 beginning at line 18 with the following paragraph:

~~For one thing, the~~ The local conditions of stress in the use of funnel casting die plates are dependent on the operating conditions. On the pouring side, they are basically determined by the kind of steel pouring temperature, the speed, the lubrication/cooling conditions of the pouring powder, the geometry of the pouring nozzle, and the corresponding flow of the molten mass. On the other side, the water side, the casting die temperatures are determined by the quality, quantity, and flow rate of the cooling water. These variables are partly determined already by the casting die design, such as in the geometry of the coolant channels.

Please replace the last paragraph on page 3 beginning at line 28 with the following paragraph:

This leads to a particularly pronounced softening of the casting die material in this transitional area of the funnel. As a result of the locally relatively higher temperatures and

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the higher material loads related to the respective resistance to heat of a material-volume element, cracks can appear prematurely in this surface area. These cracks are ~~the more~~ likely to occur due to a diffusion process, marked here as temperature dependent, of Zn-atoms from the steel into the Cu-matrix, because the Cu-Zn phases which arise form a hard and brittle surface layer which makes possible higher rate of crack formation.

Please replace the paragraph on page 5 beginning at line 3 with the following paragraph:

Alternatively, the coolant channels can be brought closer to the surface locally; in this case, the system operates, in an unusual fashion, with varying -- effectively active -- cooling wall thicknesses above the cooling water. The same applies to the cooling bore holes. In addition, broad-side plates, configured having groove-shaped coolant channels, in the critical areas of the funnel transition can be provided with additional cooling bore holes; in a surprising manner, in spite of the small wall thickness, the resistance to cracks of the casting die material is also increased ~~also~~ here and with it the overall durability of the casting die plate.

Please replace the paragraph on page 6 beginning at line 4 with the following paragraph:

Thus a maximum surface temperature ~~this is~~ reduced by 28°C ~~is achieved~~; this preferred cooling is maintained given appropriate reworking of casting die plate 1. although the wall thickness d2 in critically stressed area 5 is 2 mm smaller, the result, surprisingly, is still a generally greater service lifetime of casting die plate 1, including reworking. Area 5, which is more intensively cooled due to cooling grooves 6 that are placed deeper (wall thickness between pouring and cooling surface 18 mm instead of 20 mm), extends, in the present case, over the following surfaces (see Figure 1): the horizontal length from turning point B of funnel 2 more than 370 mm to end point D. The more intensive cooling surface extends from plate upper edge 7 up to 200 mm in the pouring direction GR; adjoining is a transitional zone 8 of 50 mm, in which the depth d of cooling grooves 6 is adjusted.

IN THE CLAIMS:²

1. (AMENDED) A liquid-cooled casting die for a continuous billet casting ~~installation~~, comprising:

a form-giving casting die body made of a material of high heat conductivity, the casting die body having a cooling-surface side in thermally and mechanically stressed areas thereof,

wherein the casting die body has a cooling zone on said cooling-surface side, said cooling zone having a greater rate

² For the Examiner's convenience all of the claims, regardless of whether amended or not, are presented.